A uniform techno-economic and environmental assessment for electrical and thermal storage in Switzerland

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Introduction

- Energy storage (ES) allows to provide dispatchable renewable energy (RE) which is a necessity to balance supply and demand.
- Development of a new assessment methodology for electrical and thermal storage integration in Switzerland.

Methodology

The key aspects of the methodology are represented in Figure 1:

- A technical, economic and environmental analysis.
- The definition of system boundaries including the ES unit, ES application and the economic/regulatory context.
- The calculation of indicators which quantify the performance of ES for the energy system and allow the comparison (Figure 2):
    - Between different ES technologies
    - With ES competitors
    - With a reference case
- A dynamic approach is considered accounting for the time-dependency of ES, RE generation, demand load and energy prices.
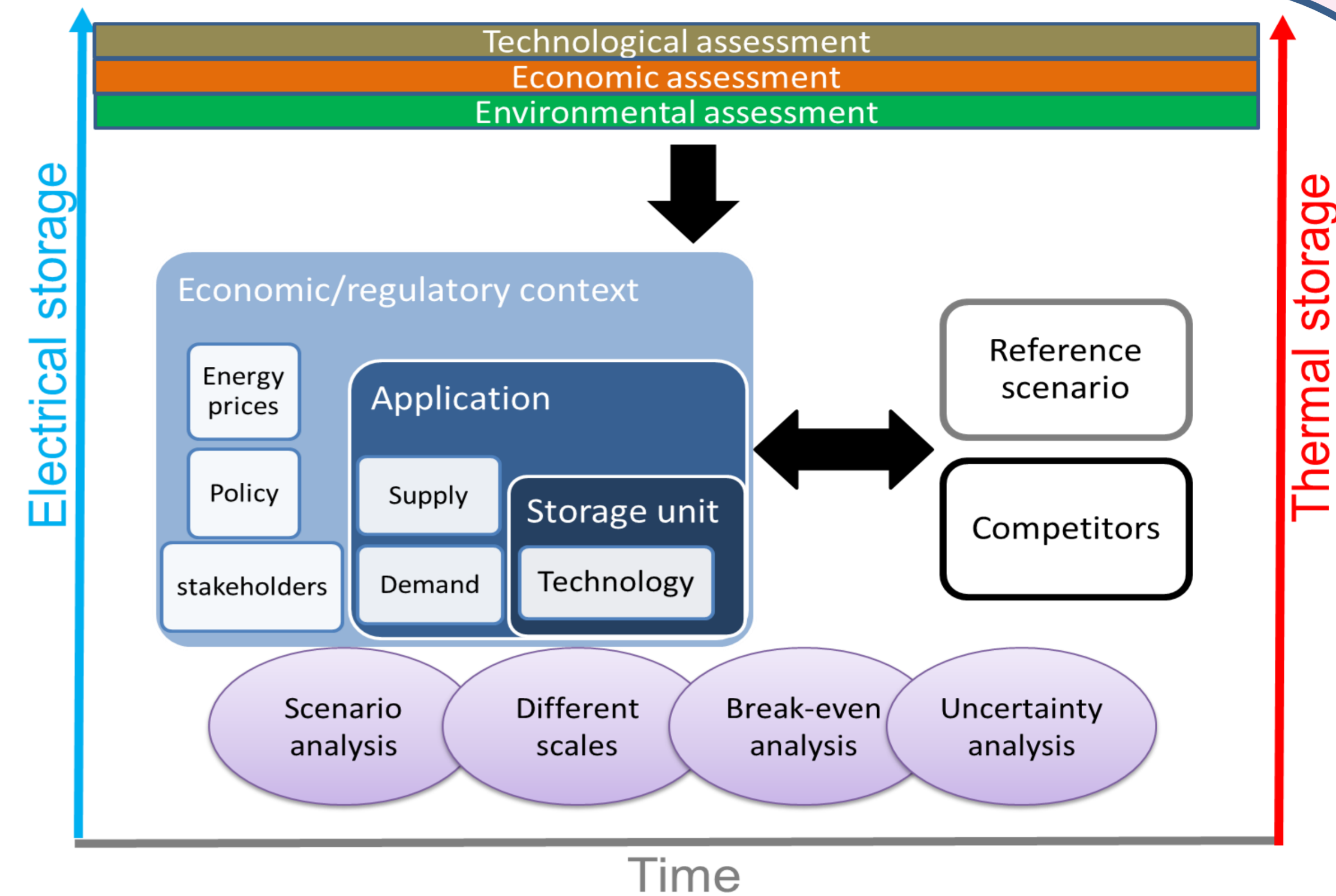

Figure 1: Schematic representation of the ES assessment being developed and its dependency with time.
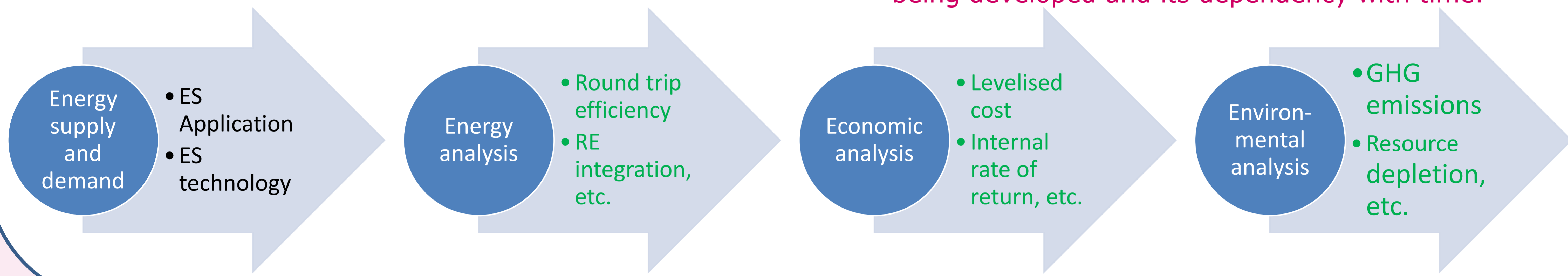

Figure 2: Method being followed in order to perform the techno-economic and environmental assessment

ES focus at the University of Geneva

ES for load shifting/energy arbitrage

- Top-down approach for different systems scales e.g., single home, community, etc.
- Considering the impact of RE generation on energy prices.

Work in progress: Assessing the performance of ES technologies performing energy arbitrage/load-shifting depending on the price volatility (Figure 3) and the scale.
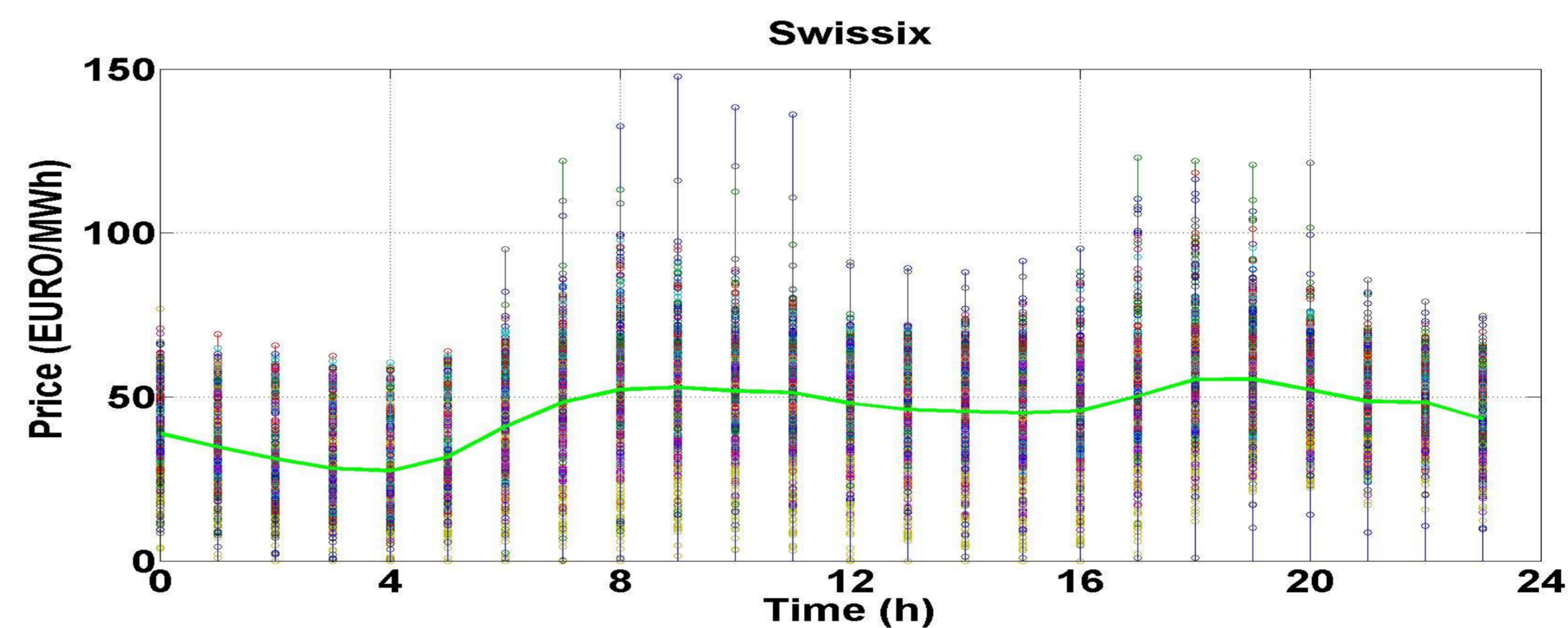

Figure 3: Swissix prices from the day-ahead market for every day in 2013 and the average depending on the hour.

ES for distributed RE generation

- Impact of dynamic tariffs on the performance and the economic benefits of ES when participating in the wholesale market without feed-in tariffs incentives.

(CHF/year)	Simple profile (22.5 cents/kWh)	Double profile (24.6 & 15.5 cents/kWh)	24-period tariff wholesale market
Export revenue	60.1		
Self-consumption avoided cost	227.5	223.9	230.7

Table 1: PV revenue due to export and avoided cost due to self-consumption for a 3 kWp PV array on a single home.

Work in progress: Assessing the performance of ES technologies performing RE time-shift in single homes and communities depending on the electricity tariffs.

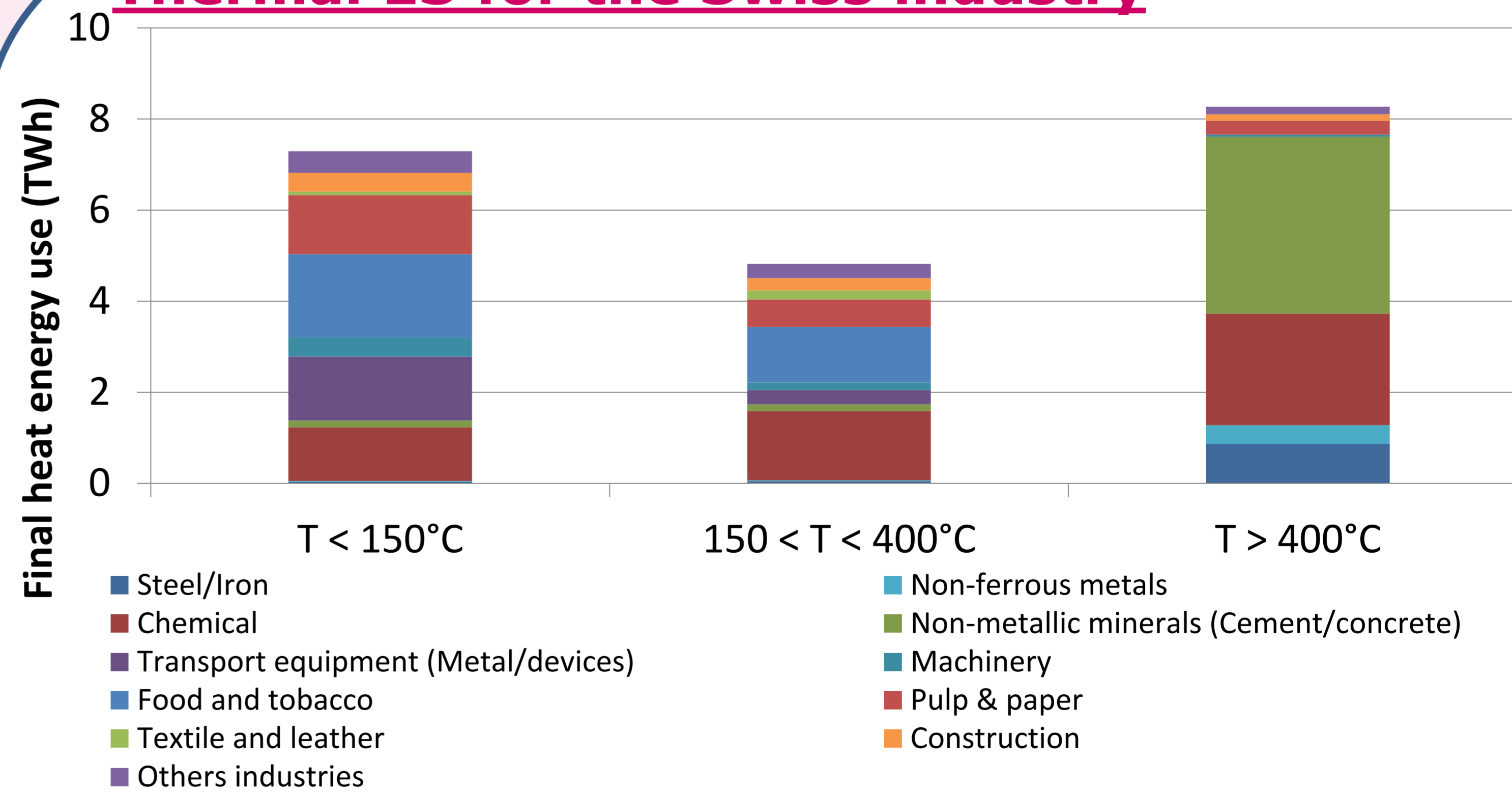### Thermal ES for the Swiss industry

Figure 4: Breakdown of the final heat energy demand for the Swiss industry by temperature level (preliminary results, based on temperature for EU.)

Work in progress: Obtain first understanding about suitable thermal storage technologies by sector.

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